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Project Report

PA-229-7
(RSP)

Data Reduction Program Documentation
ALCOR Tape Read Package

(Effective: April 1971)

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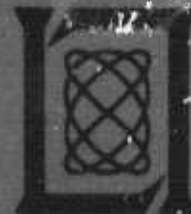
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DATA REDUCTION PROGRAM DOCUMENTATION
ALCOR TAPE READ PACKAGE
(EFFECTIVE: APRIL 1971)

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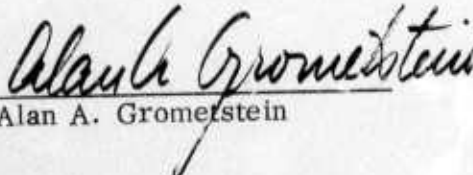
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FOREWORD

This is the seventh report in the Data Reduction Program Documentation series. It is dated according to the date of completion of the documentation. No implication is made that this program will not subsequently be modified, amended, or superseded, on the contrary, the history of radar data processing is one of continuous evolution of techniques, and it is unrealistic to assume that steady-state has been reached. The PA-229 series is being published for the convenience of interested parties, and Lincoln assumes no responsibility for the correctness of the information presented, nor for its currency.

The preparation of reports in this series is under the Editorship of Charles R. Berndtson of Lincoln, and of D.E. Nessman and R.H. French of Philco-Ford Corporation. Inquiries, suggestions, corrections, criticisms, and requests for additional copies should be directed to C.R. Berndtson.

The principal contributor to this report was G. L. Shapiro (Philco-Ford). Due to the intricate, evolutionary manner in which the programs came into being, the editors regret that it is in general impossible to give due credit to all -- mathematicians or radar analysts or programmers -- who contributed to the definition and writing of the programs.


Alan A. Grometstein

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COMMON SYMBOLS AND ABBREVIATIONS

(The units given for certain quantities are the units commonly used for those quantities, unless otherwise noted.)

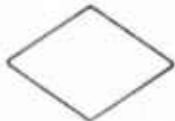
| | |
|--------|---|
| ADT | ALCOR Data Tape |
| ALCOR | ARPA -Lincoln C-band Observables Radar |
| ALTAIR | ARPA Long-Range Tracking and Instrumentation Radar |
| Alt | Altitude (km) |
| APS | Average Pulse Shape |
| ARS | ALTAIR Recording System |
| Avg | Average, Averaging |
| Az | Azimuth (deg) |
| CADJ | Adjusted Calibration Constant (db) |
| C-band | ALCOR frequency, 5664 MHz (NB) and 5667 MHz (WB) |
| DBLT | Wide Band Pulse Doublet |
| EI | Elevation (deg) |
| EOF | End of File |
| GMT | Greenwich Mean Time |
| h | Hours |
| Hz | Hertz |
| IF | Intermediate Frequency |
| in | Inches |
| LC | Left Circular Polarization |
| lsb | Least Significant Bit |
| min | Minutes |
| NB | Narrow Band |
| NRTPOD | Non-real Time Precision Orbit Determination Program |
| POD | Project PRESS Operation and Data Summary Report |
| Phase | Presented in deg |
| PRF | Pulse Repetition Frequency (pps) |
| PRI | Pulse Repetition Interval (s) |
| pps | Pulses per second |
| pts | Points |

| | |
|-----------------|-------------------------------------|
| R | Range (km) |
| \dot{R} | Range Rate (km/s) |
| rad | Radians |
| RC | Right Circular Polarization |
| RCS | Radar Cross Section (dbsm) |
| RF | Radio Frequency |
| s | Seconds |
| SD | Standard Deviation of Wake Velocity |
| SD _w | Wide Band Slaved Pulse Doublet |
| SDBLT | |
| S/N | Signal-to-noise Ratio |
| T | Time |
| TAL | Time After Launch (s) |
| UHF | ALTAIR Frequency; 415 MHz |
| V | Velocity |
| V _d | Doppler Velocity |
| V _w | Mean Wake Velocity |
| VHF | ALTAIR Frequency; 155.5 MHz |
| WB | Wide Band |
| WBS | Wide Band Slaved |
| θ | Total Off-axis Angle (deg) |
| λ | Wavelength |
| * | Denotes Multiplication |

FLOW DIAGRAM SYMBOLS



PROCESS, ANNOTATION



DECISION



TERMINATOR



SUBROUTINE: where NAME is the entry call into the subroutine



CONNECTOR: where P specifies a page in the flow diagram, and L designates a statement number in the program listing or a reference point in the flow diagram



CONNECTOR: where X implies a continuation of the diagram to the next page



INPUT/OUTPUT OPERATION



MAGNETIC TAPE



PUNCHED CARD



DISK



ALCOR TAPE READ PACKAGE

The ALCOR Tape Read Package retrieves data from the ALCOR Data Tape. ~~(ADT)~~ It contains two IBM 360 assembler language subroutines which are called from the user's program. They are READJS and UNPACK.

A. READJS (See Appendix A.)



The first call to READJS opens the file and reads the ADT header record. The second call to READJS reads the ADT calibration record and stores the values in a buffer area. The main program extracts the individual calibration values it requires. Each subsequent call to READJS reads an ADT data record consisting of eight ALCOR pulses.

If a parity error or an end of file condition is encountered by READJS, indicators are set and transferred to the main program.

The call statement is READJS (INBUF, IEOF, IERR).

INPUT

INBUF First word in an ADT record[#]

OUTPUT

IEOF Indicator set if EOF is encountered

(0 = no EOF; 1 = EOF found)

IERR Indicator set if parity error is encountered

(0 = no parity error; 1 = parity error found)

B. UNPACK (See Appendix B.)

UNPACK unpacks the raw data from the ADT, and translates it into a format usable by the IBM 360/67 computer. The call statement is UNPACK.

[#] INBUF (2) to INBUF (1803) contain the remaining words in the record.

Unpacked data for each pulse is transferred to the main program by a fixed common statement which is part of the main program. The common statement differs slightly depending on the program used.

The listing in Appendix B is used in ALCTAP and ALC10. Listings for the versions used by ALCPOD, ALC102, and ALERT are given in the reports describing those programs.

All items used in any common statement are defined below. Many items have been retained in the common statement even though they are no longer used because of changes in tape format.

STORED IN COMMON

| | |
|---------------------|--|
| INBUF | ADT data record consisting of 8 pulses (900 bytes/pulse) |
| IAZ | Az encoder angle (lsb = $360 * 2^{-17}$ deg) |
| IEL | EI encoder angle (lsb = $360 * 2^{-17}$ deg) |
| INDEX | Not used |
| IPPRCS | Tracked target NB LC RCS (lsb = 1 dbsm) |
| IORS | Not used |
| IRANGE [#] | Uncorrected R (lsb = $14.989125 * 2^{-11}$ m) |
| IPKPWR | Peak transmit power ^{##} (counts) |
| IRDOT | Range rate (lsb = $14.989125 * 2^{-13}$ m/s) |
| IALT | Not used |
| INDAZ | Not used |
| JNDAZ | Not used |
| INDEL | Not used |
| 1RB54 | LC amplitude (counts) in Range Gate 52 |
| 1RB85 | Not used |
| IOPRCS | Tracked target NB RC RCS (lsb = 1 dbsm) |
| 1240B1 | Reference channel log detector count |
| 1240B2 | Δ Az log detector count |
| 1240B3 | Δ EI log detector count |
| 1241B1 | Reference phase detector count |
| 1241B2 | Δ Az phase detector count |
| 1241B3 | Δ EI phase detector count |

[#] See Appendix C.

^{##} This is a misnomer. It is a value used in peak transmit power computation. ¹

| | |
|---------------------|--|
| XPPAGC [#] | Total LC Attenuation (lsb = 1 db) |
| IBETA | Not used |
| NEWA | Attenuation flag: 0 = prior to 15 Oct 1970 1 = after 15 Oct 1970 |
| IBAND | Not used |
| NSW ^{##} | Flag: 0 = compute transmission time of pulse 1 = do not compute transmission time |
| RBIAS [†] | 8 range bias words [RBIAS (1) - RBIAS (8)] used for correcting R (μ s) |
| ISVPRI | Not used |
| IHRS | Time pulse received, GMT h (lsb = 1 h) |
| IMIN | Time pulse received, GMT min (lsb = 1 min) |
| ISEC | Time pulse received, GMT s (lsb = 1 s) |
| IMSEC | Time pulse received, GMT ms (lsb = 1 ms) |
| ISTAT | Used by Subroutine STATUS called only by ALERT ² |
| TRBIAS [†] | Range bias |
| ISTAT1 | Not used |
| ISTAT2 | Not used |
| ISTAT3 | Not used |
| ISTAT4 | Not used |
| IALSW | } Used by Subroutine STATUS called only by ALERT ² |
| ISTSW | |
| NBWB | Not used |
| ISIGNO | Not used |

[#] See Appendix D.

^{##} Only in ALCPOD common statement.

[†] See Appendix E.

| | |
|----------------------|---|
| I27B12 [#] | Pulse transmission: 0 = NB only; 1 = NB and WB |
| I115B2 ^{##} | Not used |
| JCON | Counts pulses/record; when count reaches 9, a new record is read and count is reinitiated |
| NBEG | Initial pulse no. requested |
| NEND | Not used |
| ITST | Program Flag; indicates averaging interval completed |
| NUMPRI | PRI count |
| XOPAGC [†] | Total RC attenuation (1sb = 1 db) |
| ITBAND | Bandwidth: 0 = NB; 1 = WB |
| ITAPNO | Not used |
| IPRF ^{††} | PRF |
| IPOLAR | Polarization: 0 = LC; 1 = RC |
| ISSERR [†] | Attenuation slow switch flag: 0 = attenuation usable; 1 = attenuation indeterminate |
| PIFA | 16 step LC IF attenuation (db) |
| OIFA | 16 step RC IF attenuation (db) |

[#] Not in ALERT common statement.

^{##} Only in ALERT common statement.

[†] See Appendix D.

^{††} See Appendix F.

PFSA LC fast switch RF attenuation (db)
 OFSA RC fast switch RF attenuation (db)
 PSSA LC slow switch RF attenuation (db)
 OSSA RC slow switch RF attenuation (db)
 PSSL LC slow switch attenuator loss (db)
 OSSL RC slow switch attenuator loss (db)
 ICODE Code designating type of pulse:
 0 = NB
 1 = WB
 2 = Phantom (not expected on ADT)
 3 = WBS
 4 = not used
 5 = DBLT
 6 = not used
 7 = SDBLT

I273B5 Code for WBS waveform transmission: 0 = off; 1 = on
 I273B6 Code identifying altitude region: 0 = endoatmospheric (< 120 km);
 1 = exoatmospheric (> 120 km)
 I273B7 Mode for control of offset range gates: 0 = automatic control[#];
 1 = manual control
 I273B8 DBLT waveform transmission: 0 = off; 1 = on
 IMOVP Indicates whether primary and offset range gates are being moved
 manually; 62 to 66 counts: not moved; < 62 or > 66 counts: are
 moved; the separation between the primary and offset gates remains
 constant
 IMOVO Indicates whether offset range gates are being moved manually;
 62 to 66 counts: not moved; < 62 or > 66 counts: are moved
 IOFFST Range offset (WBS and SDBLT) (lsb = $14.989125 * 2^{-11}$ m)

[#] Range offsets are a function of altitude region.

XDPTIM[#] Pulse transmit time (GMT total s) (lsb = 10^{-6} s)
IDAT^{##} 680 amplitude and phase data words for LC and RC (counts)

REFERENCES

1. "ALCOR Data Users Manual", (U), LM-86, Lincoln Laboratory, M.I.T. (17 June 1970), UNCLASSIFIED.
2. "Data Reduction Program Documentation, ALERT, (Effective: April 1971)", PA-229-11, Lincoln Laboratory, M.I.T. (to be published), UNCLASSIFIED.

[#] Only in ALCPOD common statement.

^{##} Not used in ALERT common statement.

APPENDIX A
SUBROUTINE READJS PROGRAM LISTING

```

*          CALL READJS(INBUF,IEOF,IERR)
          START
          ENTRY READJS
          SPACE
XZBUF     EQU    4
XECF     EQU    5
XERR     EQU    6
BASE     EQU    12
          SPACE
READJS    SAVE   (14,17),T,*
          BALR   12,C
          USING *,BASE
          ST    13,SAVEA+4
          LA   7,SAVFA
          ST   7,B(0,13)
          LR   13,7
          SPACE
          LM   XZBUF,XERR,0(1)
          SPACE
          L    7,IFRST1
          C    7,ZERO
          BNE  WHICHF
          SPACE
          OPEN (INDCB,(INPUT))
          REAC RDB3,SF,INDCB,BUFF1,7212
          CHECK RDB3
          MVC  BUFNUM(4),ZERO
          MVC  IFRST1(4),ONE
          B    SK1
          SPACE
WHICHF    L     3,BUFNUM
          S     3,ONE
          BM   NEXTBUF2
          B    NEXTBUF1
          SPACE
NEXTBUF1  MVC  BUFNUM(4),ZERO
          CHECK RDB1
SK1       REAC RDB2,SF,INDCB,BUFF2,7212
          L    9,ABUFF1
          B    LCOPIQ
          SPACE
NEXTBUF2  MVC  BUFNUM(4),ONE
          CHECK RDB2

```

```

      READ  RDB1,CF,INDCB,BUFF1,7212
      L     9,ABUFF2
      SPACE
LCCPG  LR    10,XZPUF
      SR    11,11
      SR    3,3
      LA    8,1803
LCCPZ  L     7,0(3,9)
      ST    7,0(11,10)
      BCT   8,INDUP
      B     CUTLP
INDUP  LA    3,4(3)
      LA    11,4(11)
      B     LCCPZ
CUTLP  B     RETURN
      SPACE
BADRD  L     2,ONE
      ST    2,0(XFRR)
      BR    14
      SPACE
ENDFILE L    2,ONE          STORE END OF FILE INDICATOR
      ST    2,0(XEOF)
S99    CLOSE (INCCD,LEAVE)
RETURN L    13,SAVEA+4
      RETURN (14,12),T
      SPACE
INDCB  CNOP  0,8
      DCB   DSORG=PS,MACRF=(RC),DEV D=TA,DEN=2,BLFNO=1,ECCAD=ENDFILE,C
          SYNAD=BADRD,BFTEK=S,DDNAME=FT11FOO1
      SPACE
      CNOP  0,4
ZERO   DC    F'0'
CNE    DC    F'1'
TWC    DC    F'2'
IFRST1 DC    F'0'
BUFNUM DC    F'0'
      SPACE
ABUFF1 DC    A(BUFF1)
ABUFF2 DC    A(BUFF2)
SAVEA  DC    18A(*)
      SPACE
BUFF1  DS    1803F
BUFF2  DS    1803F
      END

```

APPENDIX B
SUBROUTINE UNPACK PROGRAM LISTING

```

CSECT
ENTRY UNPACK
UNPACK  SAVED
        DROP 15
        CNOP 0,4
        BALR 2,0
        USING START,2,3
START   L 3,BASA
        L 4,CUBUF
        L 5,CUBUF
        L 6,CUBUF
        A 5,=F'4096'
        A 6,=F'0192'
        USING CUBUF,4,5,6
        B START1
CUBUF  DC V(1000)
BASA   DC A(START+4096)
START1 LA 8,INBUF NUMPRI=8*INPR-1)+JCON
        MVC TEMP(1),0(8)
        MVC TEMP2(3),0(8)
        L 9,TEMP
        SLL 7,8
        SRL 9,16
        S 9,CNE
        SR 8,8
        M 8,EIGHT
        A 9,JCON
        ST 9,NUMPRI
        L 9,NPE
        C 9,NUMPRI
        BH CDELTAR
SPACE
        LA 8,WD273
        A 8,INDEX
        MVC TEMP(1),0(8)
        L 9,TEMP
        N 9,=X'F0000000'
        SRL 9,28
        ST 9,ICDRE
        L 9,TEMP
        N 9,=X'08000000'
        SRL 9,27
        ST 9,1273B5
        L 9,TEMP
        N 9,=X'04000000'
        SRL 9,26
        ST 9,1273B6
        L 9,TEMP
        N 9,=X'02000000'
        SRL 9,25
        ST 9,1273B7
        L 9,TEMP
        N 9,=X'01000000'
        SRL 9,24
        ST 9,1273B8
        L 9,TEMP
        N 9,=X'00100000'
        SRL 9,20
        ST 9,1273B12

```

COMPUTE THE CODE FOR PRI

 WBS MCDE INDICATOR

 ENDO-EXC SCAN INDICATOR

 WBS SCAN MCDE INDICATOR

 DCUBLET MCDE INDICATOR

 NB/WB INDICATOR

```

GOCODI  SPACE
        LA 8,WD233 COMPUTE GMT
        A 8,INDEX
        MVC TEMP(3),0(8)
        L 9,TEMP
        N 9,=X'1FC00000'
        SRL 9,24
        ST 9,1HRS STORE HRS
        L 9,TEMP
        N 9,=X'003FC000'
        SRA 9,16
        ST 9,IMIN STORE MINS
        L 9,TEMP
        N 9,=X'00003FC0'
        SRA 9,8
        ST 9,1SEC STORE SECS
        LA 8,WD234
        A 8,INDEX
        MVC TEMP(3),0(8)
        L 9,TEMP
        N 9,=X'7FE00000'
        SRL 9,21
        ST 9,1MSEC STORE MSEC
        SPACE
        L 10,CNF
        ST 10,IXC
        LA 10,INDAT
        LA 9,WD1
        SR 11,11
LCCPC  A 9,INDEX
        SK 12,12
        LA 8,170
        SPACE
LCCPD  IC 7,0(12,9) STORE ONE POLARIZATION (PP CR OP)
        SLL 7,24
        SRL 7,24
        ST 7,0(11,10)
        BCT 8,INDUP
        LA 11,4(11)
        SPACE
        L 9,IXC GET NEXT POLARIZATION
        A 9,ONE
        ST 9,IXC
        C 9,TWO
        BE PPPH
        C 9,THREE
        BE CPLCG
        C 9,FOUR
        BE OPPH
        B OUT
        SPACE
INDUP  LA 12,1(12)
        LA 11,4(11)
        B LCCPD
PPPH  LA 9,WD5P
        B LCCPC
LPLOG  LA 9,WD11B
        B LCCPC
CPPH  LA 9,WD175
        B LCCPC

```

| | | | |
|---------|-------|-----------------|------------------------|
| CUT | SPACE | | PRF CALCULATION |
| | LA | 8, WCR064 | |
| | A | 8, INDEX | |
| | MVC | TEMP(3), 0(B) | |
| | L | 9, TEMP | |
| | ST | 9, WCR064 | |
| | LA | 8, WCR273 | |
| | A | 8, INDEX | |
| | MVC | TEMP(3), 0(B) | |
| | L | 9, TEMP | |
| | ST | 9, WCR073 | |
| | L | 9, WCR064 | |
| | N | 9, =X'FFFE000' | |
| | SRL | 9, 13 | |
| NZSTMP | ST | 9, STMP | |
| | L | 9, =F'10C00000' | |
| | SR | 8, 8 | |
| | D | 8, STMP | |
| | ST | 9, STMP | TRANSMITTED PRF |
| | SPACE | | |
| | L | 9, INBUF | |
| | SRL | 9, 31 | |
| | C | 9, ZER0 | |
| | BNE | WBAND | |
| | SPACE | | |
| | L | 9, WCR073 | IN NARROW BAND |
| | N | 9, =X'01C00000' | BIT 8 |
| | SRL | 9, 24 | |
| | C | 9, ZER0 | |
| | BE | SLV0UP1 | |
| | SPACE | | |
| XDIV | L | 8, F0UP | IN D0UBLET MODE |
| XCIV1 | ST | 8, DIVSR | |
| | B | NEWPRF | |
| | SPACE | | |
| SLVDUB1 | L | 9, WCR073 | BIT 5 |
| | N | 9, =X'0BC00000' | |
| | SRL | 9, 27 | |
| | C | 9, ZER0 | |
| | BE | NBNWBN | IN SLAVED D0UBLET MODE |
| | B | XCIV1 | |
| NBNWBN | L | 9, WCR073 | BIT 12 |
| | N | 9, =X'0010C000' | |
| | SRL | 9, 20 | |
| | C | 9, ZER0 | |
| | BE | NCDIVS | |
| | L | 8, TWO | NB/WB E.C.P. |
| | B | XCIV1 | |
| NCDIVS | L | 8, ONE | NB ONLY |
| | B | XCIV1 | |
| | SPACE | | |
| WBAND | L | 9, WCR073 | BIT 8 |
| | N | 9, =X'01C00000' | |
| | SRL | 9, 24 | |
| | C | 9, ZER0 | |
| | BNE | SLV0UP2 | IN D0UBLET MODE |
| | L | 8, TWO | |
| | B | XCIV1 | |
| SLVDUB2 | L | 9, WCR073 | BIT 5 |
| | N | 9, =X'08C00000' | |

| | | | |
|--------|-------|----------------|------------------------|
| | SRL | 9,27 | |
| | C | 9,ZERO | |
| | BNE | XDIV | IN SLAVED DOUBLET PCDE |
| | L | 8,TWO | |
| | B | XDIV1 | WB ONLY |
| | SPACE | | |
| NEWPRF | SR | 8,8 | |
| | L | 9,STEMP | |
| | D | 8,DIVSR | |
| | ST | 9,IPRF | |
| NEXTh | LA | 8,WC237 | |
| | A | 8,INDEX | |
| | MVC | TEMP(3),0(8) | |
| | L | 9,TEMP | |
| | N | 9,=X'7FFFC000' | |
| | SRL | 9,14 | |
| | ST | 9,IAZ | STORE A2 |
| | LA | 8,WC236 | |
| | A | 8,INDEX | |
| | MVC | TEMP(3),0(8) | |
| | L | 9,TEMP | |
| | N | 9,=X'7FFFC000' | |
| | SRL | 9,14 | |
| | ST | 9,IEL | STORE ELEV |
| GCCCN | LA | 8,WC265 | |
| | A | 8,INDEX | |
| | MVC | TEMP(3),0(8) | |
| | L | 9,TEMP | |
| | N | 9,=X'FFFE0000' | |
| | SRL | 9,13 | |
| | ST | 9,TEMP2 | |
| | LA | 8,WC267 | |
| | A | 8,INDEX | |
| | MVC | TEMP(3),0(8) | |
| | L | 9,TEMP | |
| | N | 9,=X'FFFF0000' | |
| | SRL | 9,16 | |
| | A | 9,TEMP2 | |
| | SLL | 9,11 | |
| | ST | 9,TEMP2 | |
| | LA | 8,WC266 | |
| | A | 8,INDEX | |
| | MVC | TEMP(3),0(8) | |
| | L | 9,TEMP | |
| | N | 9,=X'FFE00000' | |
| | SRL | 9,21 | |
| | A | 9,TEMP2 | |
| | ST | 9,IRANGE | STORE RANGE |
| | LA | 8,WC115 | |
| | A | 8,INDEX | |
| | MVC | TEMP(3),0(8) | |
| | L | 9,TEMP | |
| | N | 9,=X'00FFC000' | |
| | SRA | 9,16 | |
| | ST | 9,IPK0WR | STORE PEAK POWER |
| | LA | 8,WC269 | |
| | A | 8,INDEX | |
| | MVC | TEMP(3),0(8) | |
| | L | 9,TEMP | |
| | C | 9,=F'0' | |

| | | | |
|--------|-------|----------------|--------------------------------|
| | BNL | DCTG1 | |
| | N | 9,=X'7FFFFFF0' | |
| | SRA | 9,8 | |
| | LCR | 9,9 | |
| | B | DCTG2 | |
| COTG1 | SRA | 9,8 | |
| COTG2 | ST | 9,IRDT | STORE R-DCT |
| | SPACE | | |
| | LA | 8,WC117 | |
| | A | 8,INDFX | |
| | MVC | TEMP(7),0(8) | |
| | L | 9,TEMP | |
| | N | 9,=X'FFCCCC00' | |
| | SRL | 9,24 | |
| | ST | 9,IMOV | ARE PRIMARY AND OFFSET MOVING |
| | SPACE | | |
| | L | 9,TEMP | |
| | N | 9,=X'0C0CFF00' | |
| | SRL | 9,8 | |
| | ST | 9,IMOV | IS OFFSET WINDOW MOVING |
| | SPACE | | |
| | SR | 9,9 | |
| | ST | 9,ICFFST | |
| | L | 9,ICOF | |
| | C | 9,THRE | |
| | BE | OFFCOM | |
| | C | 9,SEVEN | |
| | BE | OFFCOM | |
| | B | OFFSKP | |
| | SPACE | | |
| OFFCOM | LA | 8,WC278 | |
| | A | 8,INDFX | |
| | MVC | TEMP(3),0(8) | |
| | SR | 9,9 | |
| | L | 9,TEMP | |
| | C | 9,ZERO | |
| | RNL | RPLUS | |
| | N | 9,=X'7FFFFFF0' | |
| | SRA | 9,8 | |
| | LCR | 9,9 | |
| | B | RNEG | |
| RPLUS | SRA | 9,8 | |
| RNEG | ST | 9,ICFFST | RANGE OFFSET FOR SLAVED WINDOW |
| | SPACE | | |
| OFFSKP | LA | 8,WC263 | |
| | A | 8,INDFX | |
| | MVC | TEMP(7),0(8) | |
| | L | 9,TEMP | |
| | N | 9,=X'F0C0C0C0' | |
| | SRL | 9,26 | |
| | LA | 11,PIFA | |
| | LE | 0,0(9,11) | GET VALUE FROM PIFA TABLE |
| | STE | 0,XPPAGC | |
| | L | 9,TEMP | |
| | N | 9,=X'0FC0C0C0' | |
| | SRL | 9,22 | |
| | LA | 11,CIFA | |
| | LE | 0,0(9,11) | GET VALUE FROM CIFA TABLE |
| | STE | 0,XCPAGC | |
| | L | 9,ZERO | |

| | | | |
|---------|-----|------------------|--------------------------------|
| | ST | 9, ISWSSP | |
| | ST | 9, ISWSSC | |
| | ST | 9, ISSFRR | |
| | LA | 8, WD239 | |
| | A | 8, INDFX | |
| | MVC | TEMP(3), 0(8) | |
| | L | 9, TEMP | |
| | N | 9, =X'00C00200' | CHECK BIT 23 (PFSA) |
| | C | 9, ZERO | |
| | BE | CKFSOP | |
| | LE | 0, PFSA | |
| | AE | 0, XPPAGC | |
| | STE | 0, XPPAGC | ADD IN PFSA VALUE |
| CKFSOP | L | 9, TEMP | |
| | N | 9, =X'00C00100' | CHECK BIT 24 (CFSA) |
| | C | 9, ZERO | |
| | BE | CKSSPP | |
| | LE | 0, CFSA | |
| | AE | 0, XCPAGC | |
| | STE | 0, XCPAGC | ADD IN CFSA VALUE |
| CKSSPP | L | 11, TEMP | |
| | N | 11, =X'008C2000' | |
| | C | 11, =F'0' | |
| | BNE | CKSSOP | |
| INOET | L | 8, ONE | INOETERMINATE SITUATION |
| | ST | 8, ISSFRR | |
| | B | CDELTA | |
| CKSSCP | L | 11, TEMP | |
| | N | 11, =X'004C100C' | |
| | C | 11, =F'0' | |
| | BE | INOET | |
| PPTTEST | LA | 9, WD239 | |
| | A | 9, INDFX | |
| | MVC | TEMP(3), 0(9) | |
| | L | 10, TEMP | AUX.MICR.WCRD INTC REG.10 |
| | LA | 9, WD252 | ALX.MICROWAVE WCRD INTC REG.11 |
| | A | 9, INDFX | |
| | MVC | TEMP(3), 0(9) | |
| | L | 11, TEMP | |
| | LA | 9, WD272 | |
| | A | 9, INDFX | |
| | MVC | TEMP(3), 0(9) | RANGE TR.WCRD INTC TEMP |
| | N | 10, =X'00802000' | |
| | C | 10, =X'00800000' | |
| | BNE | S74 | |
| | LE | 0, PSSL | ADD IN PSSL (CCNO.8) |
| | AE | 0, XPPAGC | |
| | STE | 0, XPPAGC | |
| | L | 9, ONE | |
| | ST | 9, ISWSSP | |
| S74 | L | 8, NEWA | OLD OR NEW ATTEN. |
| | C | 8, ZERO | |
| | BE | OPTTEST | |
| | L | 9, TEMP | |
| | N | 9, =X'00800000' | |
| | C | 9, =F'0' | |
| | BE | R0BKLC | ATTENLATOR READBACK |
| | N | 11, =X'08000000' | S74 ARMED |
| | C | 11, ZERO | STATUS READ BACK |
| | BNE | SLC | |

| | | | |
|---------|-----|-----------------|--------------------------------|
| NOATTLC | LE | 0,PREVLC | |
| | STE | 0,XPPAGC | |
| | MVC | JSWLC(4),ONE | |
| | MVC | ISSERR(4),ONE | |
| | B | OPTEST | |
| RDBKLC | N | 11,=X'04000000' | S74 NOT ARMED |
| | C | 11,ZERO | STATUS REACBACK |
| | BE | NCATTLC | |
| | B | OPTEST | |
| SLC | LE | 0,PSSA | |
| | AE | 0,XPPAGC | ADD IN PSSA (COND.B) |
| STORLC | STE | 0,XPPAGC | |
| | MVC | ISWSSP(4),ONE | |
| CPTES / | LA | 9,WD239 | |
| | A | 9,INDEX | |
| | MVC | TEMP(3),0(9) | |
| | L | 10,TEMP | AUX.MICR.WCRD INTC REG.10 |
| | LA | 9,WD252 | AUX.MICROWAVE WORD INTC REG.11 |
| | A | 9,INDEX | |
| | MVC | TEMP(3),0(9) | |
| | L | 11,TEMP | |
| | LA | 9,WD272 | |
| | A | 9,INDEX | |
| | MVC | TEMP(3),0(9) | RANGE TR.WCRD INTC TEMP |
| | N | 10,=X'0C4C1000' | |
| | C | 10,=X'0C400000' | |
| | BNE | S75 | |
| | LE | 0,OSSL | ADD IN CSSL (COND.B) |
| | AE | 0,XCPAGC | |
| | STE | 0,XCPAGC | |
| | L | 9,ONE | |
| | ST | 9,ISWSSC | |
| S75 | L | 8,NEWA | OLD OR NEW ATTEN. |
| | C | 8,ZERO | |
| | BE | CUT1 | |
| | L | 9,TEMP | |
| | N | 9,=X'00C4C000' | |
| | C | 9,=F'0' | |
| | BE | RDBKRC | ATTENLATER REACBACK |
| | N | 11,=X'02000000' | S75 ARMED |
| | C | 11,ZERO | STATUS READ BACK |
| | BNE | SRC | |
| NCATTRC | LE | 0,PREVRC | |
| | STE | 0,XCPAGC | |
| | MVC | JSWRC(4),ONE | |
| | MVC | ISSERR(4),ONE | |
| | B | CUT1 | |
| RDBKRC | N | 11,=X'0100000C' | S75 NOT ARMED |
| | C | 11,ZERO | STATUS REACBACK |
| | BE | NCATTRC | |
| | B | CUT1 | |
| SRC | LE | 0,OSSA | |
| | AE | 0,XCPAGC | ADD IN OSSA (COND.B) |
| STORCC | STE | 0,XCPAGC | |
| | MVC | ISWSSP(4),ONE | |
| CUT1 | L | 9,JSWLC | |
| | C | 9,ZERO | |
| | BNE | CUT2 | |
| | LE | 0,XPPAGC | |
| | SE | 0,=E'16' | |

| | | | |
|----------|-----|----------------|-----------------------------|
| | STE | 0,XPPAGC | |
| | STE | 0,PREVLC | |
| CUT2 | L | 9,JSWPC | |
| | C | 9,ZERO | |
| | BNE | ENDAFRT | |
| | LE | 0,XCPAGC | |
| | SE | 0,=E*16* | |
| | STE | 0,XCPAGC | |
| | STE | 0,PREVRC | |
| ENDAFRT | MVC | JSWLC(4),ZERO | |
| | MVC | JSWRC(4),ZERO | |
| | L | 9,ITBAND | |
| | C | 9,ZERO | CCMPUTE RANGE BIAS |
| | BE | NRAND | |
| | LE | 2,RBIAS+16 | WIDE BAND TAPE |
| | STE | 2,TRBIAS | |
| | L | 9,IPOLAR | |
| | C | 9,ZERO | |
| | BE | LCPOLAR | |
| | LE | 2,RBIAS+20 | OP POLARIZATION |
| | AE | 2,TRBIAS | ADD WB CP BIAS |
| | STE | 2,TRBIAS | |
| | L | 9,ISWSSC | ISWSSC WAS SET IN AGC COMP. |
| | C | 9,ONE | =1,ADC 32 CB (CP) |
| | BNE | CDELTA | |
| | LE | 2,RBIAS+28 | ACC IN OPSSA- RBIAS(8) |
| | AE | 2,TRBIAS | |
| | STE | 2,TRBIAS | |
| | B | CDELTA | |
| LCPOLAR | L | 9,ISWSSP | |
| | C | 9,ONE | |
| | BNE | CDELTA | |
| | LE | 2,RBIAS+24 | ADD IN PSSA-RBIAS(7) |
| | AE | 2,TRBIAS | |
| | STE | 2,TRBIAS | |
| | B | CDELTA | |
| NRAND | LE | 2,RBIAS | NARROW BAND |
| | SYE | 2,TRBIAS | |
| | LA | 8,WC273 | CENTER OR EDGE TRACK |
| | A | 8,INDEX | |
| | MVC | TEMP(7),0(8) | |
| | L | 9,TEMP | |
| | N | 9,=X*00010000* | |
| | C | 9,ZERO | |
| | BNE | CKNBEDGE | EDGE TRACKING |
| | B | CKPOLAR | CENTER TRACK |
| CKNBEDGE | L | 8,IRDCI | CHECK SIGN OF R DCT |
| | C | 8,ZERO | |
| | BH | CKNBLOW | |
| | LE | 2,RBIAS+4 | LEADING EDGE BIAS |
| | AE | 2,TRBIAS | |
| | STE | 2,TRBIAS | |
| | B | CKPOLAR | |
| CKNBLOW | LE | 2,RBIAS+8 | TRAILING EDGE BIAS |
| | AE | 2,TRBIAS | |
| | STE | 2,TRBIAS | |
| CKPOLAR | L | 9,IPOLAR | CHECK POLARIZATION DESIRED |
| | C | 9,ZERO | |
| | BE | CDELTA | |
| | LE | 2,RBIAS+12 | ACC NB OP BIAS |

| | | | |
|---------|-------|----------|-------------|
| | AE | 2,TRBIAS | |
| | STE | 2,TRBIAS | |
| COELTAR | RETL | | |
| TEMP | DC | F'0' | |
| TEMP2 | DC | F'0' | |
| IXC | DC | F'0' | |
| NPTAPE | DC | F'0' | |
| PRNUM | DC | F'0' | |
| IPASS | DC | F'0' | |
| ISWSSO | DC | F'0' | |
| ISWSSP | DC | F'0' | |
| DIVSR | DC | F'0' | |
| WORD64 | DC | F'0' | |
| WORD73 | DC | F'0' | |
| STEMP | DC | F'0' | |
| JSWLC | DC | F'0' | |
| JSWRC | DC | F'0' | |
| PREVLC | DC | E'0.0' | |
| PREVRC | DC | E'0.0' | |
| ZERO | DC | F'0' | |
| CNE | DC | F'1' | |
| TWC | DC | F'2' | |
| THREE | DC | F'3' | |
| FOUR | DC | F'4' | |
| SEVEN | DC | F'7' | |
| EIGHT | DC | F'8' | |
| C10 | DC | F'10' | |
| C100 | DC | F'100' | |
| C1000 | DC | F'1000' | |
| CRUF | DSECT | | |
| INBUF | CS | CL3 | |
| WD1 | DS | CL3 | PP LCG D. |
| | DS | CL48 | |
| WD18 | DS | CL3 | |
| WD19 | DS | CL3 | |
| | DS | CL27 | |
| WD29 | DS | CL3 | |
| WD30 | DS | CL3 | |
| | DS | CL81 | |
| WD58 | DS | CL171 | PP PHASE C. |
| WD115 | DS | CL3 | |
| WD116 | DS | CL3 | |
| WD117 | DS | CL3 | |
| WD118 | DS | CL171 | CP LCG D. |
| WD175 | DS | CL171 | CP PHASE C. |
| WD232 | DS | CL3 | |
| WD233 | DS | CL3 | |
| WD234 | DS | CL3 | |
| | DS | CL3 | |
| WD236 | DS | CL3 | |
| WD237 | DS | CL3 | |
| | DS | CL3 | |
| WD239 | DS | CL3 | |
| WD240 | DS | CL3 | |
| WD241 | DS | CL3 | |
| WD242 | DS | CL3 | |
| | DS | CL27 | |
| WD252 | DS | CL3 | |
| WD253 | DS | CL3 | |
| | DS | CL27 | |

| | | |
|--------|----|--------------------|
| WD263 | DS | CL3 |
| WD264 | DS | CL3 |
| WD265 | DS | CL3 |
| WD266 | DS | CL3 |
| WD267 | DS | CL3 |
| WD268 | DS | CL3 |
| WD269 | DS | CL3 |
| WD270 | DS | CL3 |
| WD271 | DS | CL3 |
| WD272 | DS | CL3 |
| WD273 | DS | CL3 |
| WD274 | DS | CL3 |
| WD275 | DS | CL3 |
| WD276 | DS | CL3 |
| WD277 | DS | CL3 |
| WD278 | DS | CL3 |
| WD279 | DS | CL3 |
| WD280 | DS | CL3 |
| | DS | CL636 ⁹ |
| IAZ | DS | 1F |
| IEL | DS | 1F |
| INDEX | DS | 1F |
| IPPRCS | DS | 1F |
| IORS | DS | 1F |
| IRANGE | DS | 1F |
| IPKPWR | DS | 1F |
| IRDOT | DS | 1F |
| IALT | DS | 1F |
| INDAZ | DS | 1F |
| JNDAZ | DS | 1F |
| INDEL | DS | 1F |
| IRB54 | DS | 1F |
| IRB85 | DS | 1F |
| IOPRCS | DS | 1F |
| I240B1 | DS | 1F |
| I240B2 | DS | 1F |
| I240B3 | DS | 1F |
| I241B1 | DS | 1F |
| I241B2 | DS | 1F |
| I241B3 | DS | 1F |
| XPPAGC | DS | 1F |
| IBETA | DS | 1F |
| NEWA | DS | 1F |
| BAND | DS | 1F |
| NSW | DS | 1F |
| RBIAS | DS | 8F |
| ISVPRI | DS | 1F |
| IHRS | DS | 1F |
| IMIN | DS | 1F |
| ISEC | DS | 1F |
| IMSEC | DS | 1F |
| STAT | DS | 21F |
| TRBIAS | DS | 1F |
| ISTAT1 | DS | 1F |
| ISTAT2 | DS | 1F |
| ISTAT3 | DS | 1F |
| ISTAT4 | DS | 1F |
| IALSW | DS | 1F |
| ISTSW | DS | 1F |
| NBWB | DS | 1F |

| | | |
|--------|-----|------|
| ISIGNO | DS | 1F |
| I27812 | DS | 1F |
| JCCN | DS | 1F |
| NBEG | DS | 1F |
| NEND | DS | 1F |
| ITST | DS | 1F |
| NUMPRI | DS | 1F |
| XOPAGC | DS | 1F |
| ITBAND | DS | 1F |
| ITAPNO | DS | 1F |
| IPRF | DS | 1F |
| IPOLAR | DS | F |
| ISSERR | DS | F |
| PJFA | DS | 16F |
| CIrA | DS | 16F |
| PFSA | DS | 1F |
| CFSA | DS | 1F |
| PSSA | DS | 1F |
| CSSA | DS | 1F |
| PSSL | DS | 1F |
| CSSL | DS | 1F |
| ICODE | DS | F |
| I27385 | DS | F |
| I27386 | DS | F |
| I27387 | DS | F |
| I27388 | DS | F |
| IMCVP | DS | F |
| IMQVC | DS | F |
| IOFFST | DS | F |
| IDAT | DS | 682F |
| | END | |

APPENDIX C

IRANGE

The raw tracked target range (IRANGE) is recorded in a set of three registers: two coarse range registers (lsb = 15 m) and one fine range register (lsb = $14.989125 * 2^{-11}$ m). IRANGE is the sum of these three ranges, which is always larger than the true target range. The main program must correct for the difference between the true range and IRANGE. #

See Appendix E and Ref. 1, Appendix E.

APPENDIX D
TOTAL ATTENUATION

The total LC (XPPAGC) and RC (XOPAGC) attenuation is computed in Sub-routine UNPACK and transferred to the main program through the common statement. The equations used for attenuation depend on the date of the mission.

A. Missions between 15 February 1970 and 14 October 1970

$$\text{XPPAGC (db)} = \text{PIFA(I)} + \text{PFSA(J)} + \text{PSSL(K)} + \text{PSSA(L)} - 16$$

$$\text{XOPAGC (db)} = \text{OIFA(I)} + \text{OFSA(J)} + \text{OSSL(K)} + \text{OSSA(L)} - 16$$

where

PIFA and OIFA are sixteen step IF attenuators. The attenuation is found in Calibration Record Words 512 - 527 (PIFA) and 528 - 543 (OIFA) as a function of I.

I is found in ADT Data Record Byte No. 787 [Bits 1-4 (PIFA), Bits 5-8 (OIFA)].

PFSA and OFSA are fast switch attenuators. The magnitude of the attenuation is given in Calibration Record Words 592 (PFSA) and 594 (OFSA).

J is found in ADT Data Record Byte No. 717 [Bit 7 (PFSA) and Bit 8 (OFSA)].

PSSL and OSSL are slow switch losses. The magnitude of the loss is found in Calibration Record Words 629 (PSSL) and 630 (OSSL).

K has three possible values determined from the ADT data record as follows:

For PSSL

| Byte 716 <u>Bit 1</u> | Byte 717 <u>Bit 3</u> | <u>K</u> |
|--------------------------|--------------------------|----------|
| 0 | 0 | # |
| 0 | 1 | 0 |
| 1 | 0 | 1 |
| 1 | 1 | # |

For OSSL

| Byte 716 <u>Bit 2</u> | Byte 717 <u>Bit 4</u> | <u>K</u> |
|--------------------------|--------------------------|----------|
| 0 | 0 | # |
| 0 | 1 | 0 |
| 1 | 0 | 1 |
| 1 | 1 | # |

Indeterminate, therefore RCS data cannot be calibrated. When this occurs, a flag (ISSERR) is set for the main program, and XPPAGC and XOPAGC do not include slow switch losses or attenuation.

PSSA and OSSA are slow switch attenuators. The magnitude of the attenuation is given in Calibration Record Words 593 (PSSA) and 595 (OSSA).

L is found in ADT Data Record Byte 815 [Bit 5 (PSSA) and Bit 6 (OSSA)].

Note: If K is zero, PSSA and OSSA are not used and L need not be checked.

B. Missions after 15 October 1970

$$\text{XPPAGC (db)} = \text{PIFA(I)} + \text{PFSA(J)} + \text{PSSA(L)} - 16$$

$$\text{XOPAGC (db)} = \text{OIFA(I)} + \text{OFSA(J)} + \text{OSSA(L)} - 16$$

L is determined by combining the command to the slow switch attenuators, found in ADT Data Record Byte 815 [Bit 5 (PSSA) and Bit 6 (OSSA)], and the status readback of the attenuators, found in Byte 754 [Bits 5 and 6 (PSSA) and Bits 7 and 8 (OSSA)].

L has three possible values determined from the ADT data record as follows:

For PSSA

| <u>Byte 815</u> <u>Bit 5</u> | <u>Byte 754</u> <u>Bit 5</u> | <u>Byte 754</u> <u>Bit 6</u> | <u>L</u> |
|---------------------------------|---------------------------------|---------------------------------|----------|
| 0 | N/A | 0 | # |
| 0 | N/A | 1 | 0 |
| 1 | 0 | N/A | # |
| 1 | 1 | N/A | 1 |

Indeterminate. When this condition exists, L is set equal to its previous value (previous pulse), XPPAGC and XOPAGC computed, and a flag (ISSERR) set for the Fortran main program.

For OSSA

| <u>Byte 815</u> <u>Bit 6</u> | <u>Byte 754</u> <u>Bit 7</u> | <u>Byte 754</u> <u>Bit 8</u> | <u>L</u> |
|---------------------------------|---------------------------------|---------------------------------|----------|
| 0 | N/A | 0 | # |
| 0 | N/A | 1 | 0 |
| 1 | 0 | N/A | # |
| 1 | 1 | N/A | 1 |

Indeterminate. When this condition exists, L is set equal to its previous value (previous pulse), XPPAGC and XOPAGC computed, and a flag (ISSFERR) set for the Fortran main program.

APPENDIX E
RANGE BIAS (TRBIAS)

TRBIAS is computed from 8 range bias words [RBIAS (1) - RBIAS (8)]
as follows:

NB Data

Polarization

LC

LC or RC

LC or RC

RC

Track

Centroid

Leading edge

Trailing edge

Centroid

TRBIAS

RBIAS (1)

RBIAS (1) + RBIAS (2)

RBIAS (1) + RBIAS (3)

RBIAS (1) + RBIAS (4)

WB Data

Polarization

LC

RC

LC

RC

Slow Switch

Attenuator

Inactive

Inactive

Active

Active

TRBIAS

RBIAS (5)

RBIAS (5) + RBIAS (6)

RBIAS (5) + RBIAS (7)

RBIAS (5) + RBIAS (8)

APPENDIX F
PRF DETERMINATION

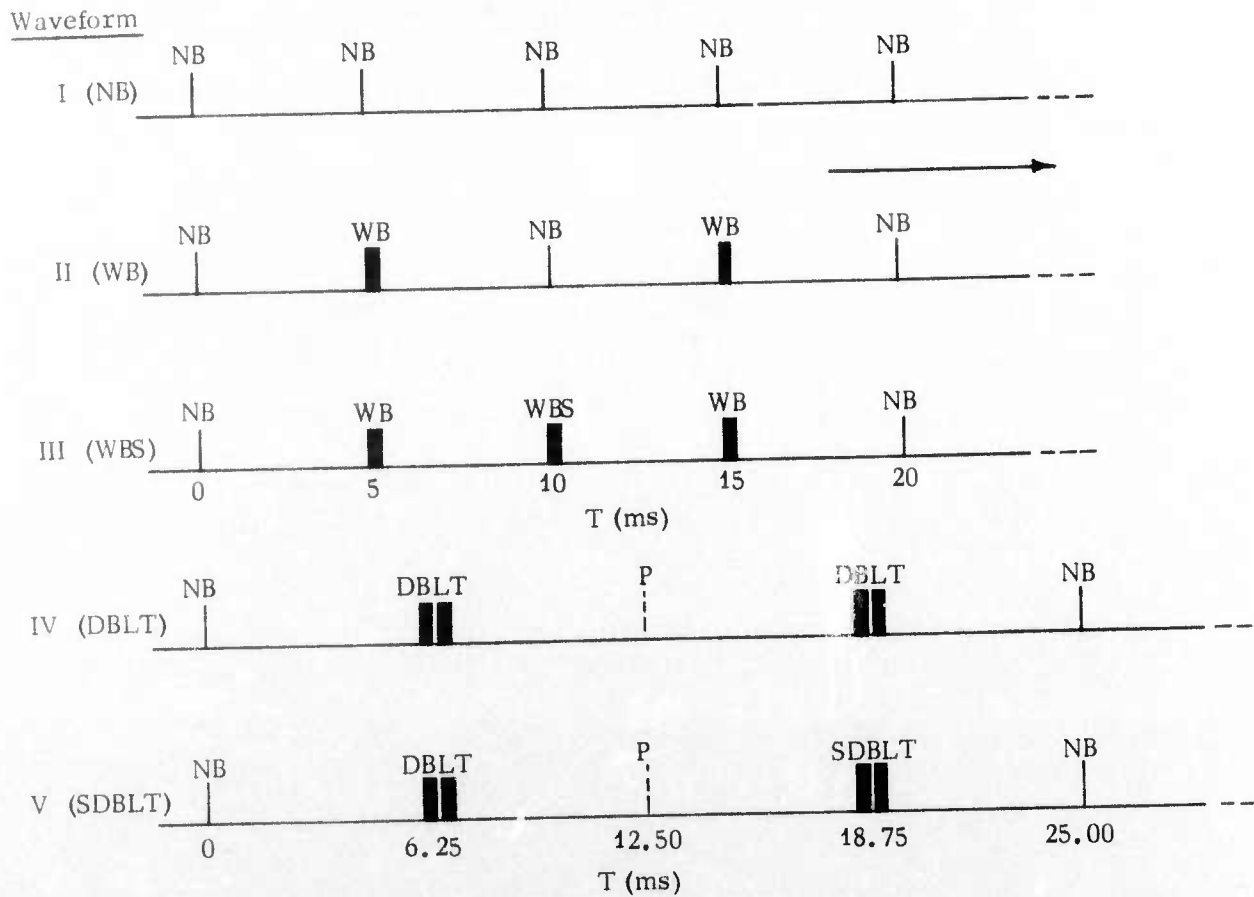
IPRF is the PRF for the particular waveform on the tape and is computed as follows:

| <u>Type of Data</u> | <u>Waveform</u> [#] | <u>IPRF</u> |
|---------------------|------------------------------|-------------|
| NB | DBLT | PRF/4 |
| NB | SDBLT | PRF/4 |
| NB | WBS | PRF/4 |
| NB | WB | PRF/2 |
| NB | NB | PRF## |
| WB | WB | PRF/2 |
| WB | DBLT | PRF/2 |
| WB | WBS | PRF/2 |
| WB | SDBLT | PRF/4 |

[#] ALCOR waveforms are shown in Fig. 1.

^{##} When in this mode the ADT may contain every pulse or, more frequently, every other pulse.

FIGURE 1
ALCOR WAVEFORMS



NOTES

1. All waveforms are shown at maximum system PRF.
2. Wide band pulse doublet leading edge to leading edge spacing is 23.2 μ s.
3. The phantom pulse (P) is an imaginary pulse inserted by the Real Time Program for timing considerations. This pulse is not found on the ADT.